AIR WAR COLLEGE

Research Report

FRICTION AND AIRPOWER DURING WWI

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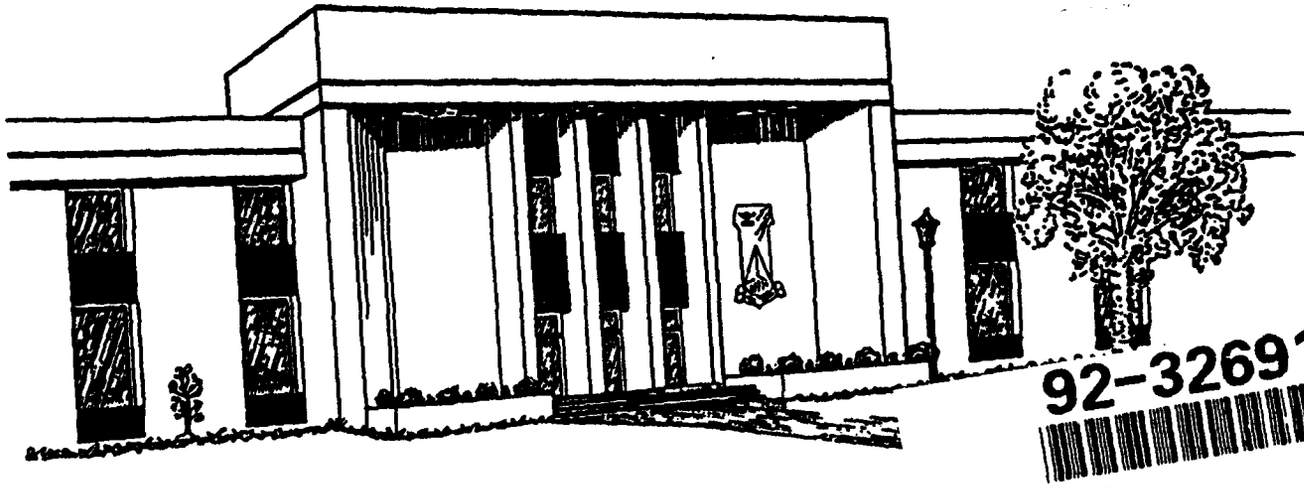
1992



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AIR WAR COLLEGE

AIR UNIVERSITY

FRICTION and AIRPOWER DURING WWI

by

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AN ESSAY SUBMITTED TO THE FACULTY

IN

FULFILLMENT OF THE CURRICULUM

REQUIREMENT

Seminar Director: Colonel Bryant P. Culberson

MAXWELL AIR FORCE BASE, ALABAMA

30 October 1991

Friction has been and will continue to be the impetus behind the evolution of both strategy and tactics in any conflict. This powerful concept provides the basic rationale for doctrine and the categorization of roles and missions of all military forces. By analyzing the use of air power at the strategic and operational levels of war during World War I, the overlooked influence of friction as the basis for combat doctrine is readily seen.

This paper examines the major contributions of air power during World War I and the development of air power doctrine from the perspective of friction. This study begins with a discussion of the concept of friction. It then illustrates how the goal of minimizing one's own friction (principally because of the need to decrease uncertainty through reconnaissance and observation) influenced the development of air power. The ensuing discussion on the employment of air power reflects the logical desire of the belligerents to expand their goal of minimizing the impact of friction upon themselves to a more aggressive goal of increasing their opponent's friction (by denying them the ability to perform reconnaissance and observation).

There are two basic key objectives in combat derived from the study's analysis of air power during World War I. The first one is the need to increase the enemy's friction. The second is the need to minimize one's own friction.

Achieving these two objectives to a greater degree than the enemy (who is implicitly or explicitly attempting to do the same) results in a major advantage that should lead to victory. This advantage has two parts. The first is the ability to make decisions

that exploit the enemy's vulnerability (or vulnerabilities). The second is to be able to exploit the ensuing success to further increase the enemy's friction. This impinges upon the enemy's ability to effectively respond. This in turn results in additional enemy vulnerabilities that, if also successfully exploited, can give birth to a self-feeding cycle which continues to increase, usually at an accelerating rate, the enemy's friction. At each cycle, the enemy loses more of his ability to maintain reliable and timely situational awareness, as well as the ability to react effectively and possibly regain the initiative. (Hence the truism to exploit success and pursue the retreating enemy immediately so that he cannot recover his balance.[1]) Eventually, the cumulative effects of this friction overwhelms the enemy's decision making processes. When the application of this friction paralyzes the enemy's ability to act, react and make decisions, the enemy collapses in defeat.[2] (*However, the cycle can be broken if ones own friction* --i.e., if fatigue or chance intervene-- denies one the ability to continue to exploit the ability to generate more friction for the enemy.)

The more specific conclusion to be drawn from this study is that air power during World War I was essential for the attainment of these objectives. In fact, the advantages associated with the two basic objectives can best be achieved through the appli-

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[1] Sun Tzu, The Art of War, trans. Samuel B. Griffith, (New York: Oxford University Press, 1963), p. 142.

[2] John R. Boyd, A Discourse on Winning and Losing, (Maxwell Air Force Base, AL: Lecture and seminar session with Air War College students in course 6122B, 16 October 1991). Mr. Boyd discussed the goal of getting inside the enemy's observation-orientation-decision-action (OODA) loop. To achieve this, one must act faster than the enemy can react. The cumulative effect should be eventual paralysis and collapse of the enemy when they are no longer able to maintain situational awareness and react rationally. My thesis, derived from Carl von Clausewitz, is that the way to achieve this goal is to speed up ones own OODA loop by decreasing ones own friction while simultaneously increasing that of the enemy.

cation of air power. This results in one cardinal principle that can be applied to future conflicts: that air power paves the way to victory because it is inherently the single best means to simultaneously decrease friendly friction and increase the enemy's.

Friction is what makes the simple difficult.[3] The concept of friction is, in my opinion, Carl von Clausewitz's most critical contribution to the study of war. In his work, he specially discussed four interrelated and interacting factors as prime elements in friction.[4] The first element is danger (which is associated with fear). Next is the element of fatigue (and this element can be expanded to include the grinding and wearing effect on equipment and the expenditure of supplies which results in exhaustion and combat ineffectiveness). The third element, related to reconnaissance and observation, is uncertainty (caused by unavailable or unreliable information). The final element is chance.

Von Clausewitz clearly identified combat experience and the commanders as the keys that reduce friction.[5] Even though he also noted that an additional factor that helps reduce uncertainty is reliable information,[6] he failed, in his unfinished work, to explicitly discuss the need to increase the enemy's uncertainty as a means to facilitate the

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[3] Carl von Clausewitz, On War, trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1984; First Princeton Paperback, 1989), p. 119.

[4] Ibid., p. 104; David MacIsaac, "Master at Arms -- Clausewitz in Full Review," in Military Studies Course - MS610, Readings: Book I, prepared by Professor William P. Snyder, Dr. David C. Skaggs and Dr. James A. Mowbray (Maxwell Air Force Base, AL: Air University, 1971), p. 167.

[5] Clausewitz, On War, pp. 120-121.

[6] Ibid., p. 117.

achievement of victory. However, he implicitly addressed this subject when he discussed the concept of surprise and the importance of controlling the high ground.[7] His failure to be more direct in the discussion of imposing additional friction on the enemy, while decreasing one's own, may in part be attributed to the state of science and technology in the early nineteenth century.[8]

Sun Tzu stressed the need to determine the enemy's dispositions while guarding one's own.[9] Where is the enemy? What is his composition and disposition? These and similar questions demand reliable answers. These answers must be available in sufficient time to permit the general to make decisions which exploit the information received. Being unaware of what is going on increases uncertainty and, therefore, friction. Such a situation creates an unacceptable and distinct disadvantage which a general must make an explicit effort to overcome in order to avoid defeat.

Therefore, reconnaissance has always been a major military mission. Before the use of air power, the most mobile forces (e.g., light troops and then cavalry) were rou-

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[7] Ibid., pp. 198-201 and 352-354. Sun Tzu probably had a better understanding of surprise than did von Clausewitz. Even though von Clausewitz believed surprise to be "the root of all operations without exception" (On War, p. 198), he felt that a general could only rarely create surprise (On War, p. 200). Sun Tzu, on the other hand, stressed the need to create and exploit surprise (The Art of War, pp. 66-67, 89, 98, 100, 133-134, and 149). The key to creating surprise is to deny the enemy reliable information. Therefore, increasing his friction yields surprise.

[8] The technology of the belligerents von Clausewitz knew was on a par. Advances in science and technology were occurring at a slow pace. Therefore, it was virtually impossible to foresee the airplane and its potential to revolutionize the methods of warfare through the application of friction. However, based on his grasp of the importance of heights, had he lived past the end of the nineteenth century, he would possibly have included technology as major factor in war and seen the need to increase the enemy's friction while decreasing one's own as a means to achieve victory.

[9] Sun Tzu, The Art of War, p. 100.

tinely employed as the commander's eyes. These forces often maintained contact with the enemy (with the dual objectives of shadowing their moves --to obtain information of his dispositions and composition-- while screening ones own --to deny the enemy similar information--) and were sometimes used to disturb and disrupt the enemy's line-of-communications.[10] Their basic role, in Clausewitzian terms, was to inflict friction on the enemy while decreasing one's own.

Reconnaissance is complemented by control of the high ground. Von Clausewitz clearly understood the importance of holding the high ground as a means of obtaining reliable information about the enemy. By controlling the high ground, one can better observe the enemy. The intelligence thus gained provides one with the possibility of hindering the enemy's ability to effect a surprise move. Furthermore, the information obtained can be used to identify enemy vulnerabilities that can then be exploited. Since control of the high ground provides the holder with such distinct advantages, it is imperative that the general deny the enemy the high ground and, if possible, to gain its control for his own benefit.

With the advent of balloons, the first manifestation of air power, there became available to generals a way to "create" high ground. However, when balloons appeared in the late eighteenth century, even great generals like Napoleon lacked the vision to fully appreciate their potential.[11] This changed as more and more experience was

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[10] Baron de Jomini, The Art of War, trans. by Capt G. H. Mendell and Lt W. P. Craig Hill (Westport, CN: Greenwood Press, undated), p. 287-288; Steven T. Ross, "Napoleon and Maneuver Warfare," in Military Studies Course - MS610, Readings: Book I, prepared by Professor William P. Snyder, Dr. David C. Skaggs and Dr. James A. Mowbray (Maxwell Air Force Base, AL: Air University, 1971), p. 156.

[11] Bernard and Fawn M. Brodie, From Crossbow to H-Bomb, (Bloomington: Indiana University

gained with this initial tool of air power. By the start of World War I, balloons became a prevalent friction reducing tool used by all the belligerents.[12]

This tool, balloons, was not without its serious drawbacks. Problems in a high wind and inclement environment, its inability to maneuver, its susceptibility to destruction by airplanes, and its lack of mobility (and thus the ability to be used as a scout) all called for another invention.[13] At first, the dirigible was thought to be the answer.[14] But its relatively slow speed and expensive construction, coupled with its balloon-like vulnerabilities and constraints, led to the dirigible's replacement by the more mobile, less expensive and more survivable airplane.[15]

Like the balloon and the dirigible, from the very first, the principal role of airplanes before and during World War I was reconnaissance (or observation).[16]

Press, 1973), pp. 109-110; Lee Kennett, The First Air War, 1914-1918, (New York: The Free Press, 1991), pp. 3-4. Technology played a crucial factor in this because it had not yet provided a platform which was either easily transportable or mobile.

[12] Georg Paul Neumann, et. al., The German Air Force in the Great War, compiled by Major Georg Paul Neumann, trans. J. E. Gurdon, (London: Hodden and Stoughton, Ltd., 1920), pp. 1-2; Kennett, The First Air War, 1914-1918, pp. 3, 23-24.

[13] David C. Cooke, Sky Battle: 1914-1918, The Story of Aviation in World War I, (New York: W. W. Norton & Co., 1970), p. 67; Kennett, The First Air War, 1914-1918, pp. 4, 24, 27-29; Neumann, The German Air Force in the Great War, pp. 1, 3, 12.

[14] Kennett, The First Air War, 1914-1918, pp. 4-5, 13 and 45-47.

[15] Ibid., pp. 46-47 and 58-59; Neumann, The German Air Force in the Great War, pp. 12, 15, and 20-21.

[16] Kennett, The First Air War, 1914-1918, pp. 30-40, and 220; Neumann, The German Air Force in the Great War, pp. 36, 131-133, 135, 143, and 157.

On 19 August 1914, a British reconnaissance flight discovered the separation between the advancing German armies on the extreme left of the allied line.[17] If the commander of the British Expeditionary Force (Sir John French) had acted decisively, air power would have immediately been recognized as having decisive and possibly catastrophic impact upon the German ability to withstand a counterattack. Instead, the allied generals moved forward in a tentative manner which resulted in German withdrawal to a defensive line across the Marne and consolidation along the entire front.[18] Eventually this led to the race to the sea and the stalemate for which World War I is best remembered.

In spite of this failure in allied leadership, before the end of 1914 aerial reconnaissance had proven itself invaluable . Its ability to provide reliable information shaped operational events and led to a major German victory on the Eastern front (i.e., Tannenburg) and limited German success on the Western front (i.e., the Anglo-French salvation at Mons and the Marne).[19] It reduced uncertainty and permitted those generals with initiative to exploit the uncovered enemy weakness.

Aircraft and balloons also affected the operational constraints generals worked under by their ability to make effective use of the long range and destructive power of artillery. Observers in airborne platforms were able to identify targets (e.g., forward depots,

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17 Cooke, Sky Battle: 1914-1918, The Story of Aviation in World War I, p. 60.

18 Ibid., p. 61.

19 Kennett, The First Air War, 1914-1918, pp. 31-32.

troop concentrations, convoy movements, artillery emplacements, bridges, crossroads, etc.) against which they would then range and register indirect fire from the batteries. When situation demanded it, the observers would then direct highly accurate artillery fire. The extremely effective use of indirect artillery fire was only available to the side possessing the aerial advantage.[20]

The result of observed indirect artillery fire was more friction on the receiving end. Battlefield telecommunications were severed and contact between the front and the rear was hindered, if not destroyed, and situational awareness was diminished. The generals who had to react did not receive the reliable and timely information they usually demanded before they made decisions. Often, the highly centralized command structure reacted incorrectly, if at all, due to an impaired capability for timely and informed reaction. Thus, aerial observation made artillery the queen of the battlefield and reconnaissance (observer) platforms a prime target for the opposing forces. [21]

As soon as the opposing generals realized the impact of aerial reconnaissance, they began to take actions which would mask their positions and protect their own resources. (Camouflage became an art; anti-aircraft artillery was established; troop and resupply movements were more often made at night; and pursuit --counter air-- mis-

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[20] Cooke, Sky Battle: 1914-1918, The Story of Aviation in World War I, pp. 102, 116, 134, 152, 167, 176, and 231; Kennett, The First Air War, 1914-1918, pp. 35 and 89-90; Neumann, The German Air Force in the Great War, pp. 150 and 152. (The specific campaigns or battles specified by Cooke are: the initial German thrust at Verdun; the British at the Somme, Vimy, Messines, and Ypres; and the German offensive of 1918.)

[21] Cooke, Sky Battle: 1914-1918, The Story of Aviation in World War I, pp. 102 and 134; Kennett, The First Air War, 1914-1918, pp. 33, 35 and 220-221; Neumann, The German Air Force in the Great War, pp. 132 and 150-152.

sions were created to blind the enemy and protect friendly observation platforms.[22]) Each of these actions was a direct response which played upon the effects of friction. They either attempted to minimize friendly friction, or they tried to increase the enemy's. In some cases, the countermeasures accomplished both tasks.

This established a major lesson of World War I that became evident to all belligerents well before the war was over. Command of the air was indisputably vital if one wanted to maintain security, effect surprise, and achieve success. Therefore, major surface operations were usually preceded by heavy aerial reconnaissance at the designated front and behind enemy lines. This activity, along with an abnormal concentration of air power, was a key indicator and warning that an offensive was in the offing.[23] By 1917, it became the norm that offensive operations were postponed if airplanes could not fly.[24]

Also, all the generals soon learned that the best countermeasure to their goal of minimizing their own friction (aerial reconnaissance and observation) while simultaneously increasing the enemy's (by denying them the use of their aerial platforms to gather information which would clear the fog of uncertainty) was successful air-to-air combat.[25] Pursuit aircraft were developed and tasked with two objectives: to drive en-

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[22] Cooke, Sky Battle: 1914-1918, The Story of Aviation in World War I, pp. 63, 99-102, 107 and 116-117; Thomas H. Greer, The Development of Air Doctrine in the Army Air Arm, 1917-1941, (Washington, D.C.: U. S. Government Printing Office, 1985), p. 5; Kennett, The First Air War, 1914-1918, pp. 64, 66, and 70-71; Neumann, The German Air Force in the Great War, pp. 38-39, 132-133, 138, 140, 143 and 177.

[23] Neumann, The German Air Force in the Great War, pp. 140-141.

[24] Kennett, The First Air War, 1914-1918, p. 89.

emy aerial observation platforms from the sky and then to defeat enemy pursuit which would protect their "eyes" and threaten one's own. Therefore, pursuit, with its air superiority (counter air) mission, became their air force's most important branch.[26] In fact, it was the aerial control won by pursuit that stymied the Germans in 1918. Pursuit denied them the ability to observe (and thus exploit) the collapse of the British Fifth Army.[27] Aerial control also permitted the Royal Flying Corps to slow the German advance long enough to form another line and seal off the penetration of the Fifth Army's front.[28]

Along with, but secondary to, reconnaissance and observation, parallel efforts to establish aerial bombardment were pursued by the major world powers prior to the outbreak of World War I. Germany and France organized bombing exercises.[29] As early as 1911, Italians were bombing their enemies in Libya.[30] However, it was not until technology satisfied the requirements for improved bombs, airframe designs and engines (which contributed to increased lethality and aircraft payload, ceiling and range) that bombing became a viable mission.[31]

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[25] Ibid., p. 71.

[26] Cooke, Sky Battle: 1914-1918. The Story of Aviation in World War I, pp. 102, 182 and 209; Greer, The Development of Air Doctrine in the Army Air Arm, 1917-1941, pp. 5, 8, 31 and 37; Kennett, The First Air War, 1914-1918, p. 72. These sources explicitly identify air superiority as the key to air power.

[27] Cooke, Sky Battle: 1914-1918. The Story of Aviation in World War I, p. 216.

[28] Ibid., pp. 212-216.

[29] Kennett, The First Air War, 1914-1918, p. 15.

[30] Ibid., p. 18.

[31] Ibid., pp. 46, 48, and 50-51; Neumann, The German Air Force in the Great War, pp. 48, and

The principal targets of bombardment during World War I were: troops in camp, truck convoys, rail stations, depots, ammunition dumps, artillery and truck parks, aerodromes, harbor facilities, central telephone and telegraph stations, and headquarters.[32] A cursory analysis of this bombing could result in the view that the goal was destruction of the enemy troops and materiel. However, with a more thorough examination of the preferred targets, it is obvious that the real, even if unstated, objective was to maximize the increase in enemy friction (by disrupting and destroying their ability to move, direct and sustain --or supply-- both defensive and offensive operations) over the widest area.

In trench strafing and other close air support missions, the friction inflicted had a limited scope restricted almost exclusively to the immediate area of the engagement. Furthermore, the friendly casualty rate of these missions was very high, often averaging from 12 to as high as 35 percent.[33] Therefore, close air support was not the preferred way to apply air power.

Air power was applied as the overwhelming battlefield force when it was the only means available to stem the tide of enemy success. It was expediency and urgency (the desire to avoid immediate catastrophe) that led to the concentrated use of air power in a close air support role. These situations occurred more than once, especially

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157-161.

[32] Cooke, Sky Battle: 1914-1918, The Story of Aviation in World War I, pp. 78, 99, 116, 134, 165, 211232, 234, 245-246, and 261-262; Greer, The Development of Air Doctrine in the Army Air Arm, 1917-1941, pp. 6, 9-11 and 33; Kennett, The First Air War, 1914-1918, pp. 43-44, 48-49, and 54; Neumann, The German Air Force in the Great War, pp. 48, 134, 165-166, and 173. These targets are usually associated more with interdiction, as opposed to close air support, missions.

[33] Cooke, Sky Battle: 1914-1918, The Story of Aviation in World War I, pp. 150 and 183-184.

during 1918.[34]

As Cyril Falls wrote, the air arm is the essential ingredient for the destruction of the enemy's defensive capabilities (especially the elimination of his artillery). It paves the way for the attack. It is the key to maneuver, surprise and victory.[35]

The way in which to achieve victory lies primarily in the hands of air power. The basis of modern air power doctrine, the primary roles of air power (air control, force application and force enhancement), was all defined during World War I. The initial rationale for air power was the need to observe and reconnoiter the enemy to gain information which improves decision making. Furthermore, these force enhancement missions were required to avoid surprise.

Then it became obvious that friendly aerial "eyes" had to be defended while simultaneously denying the enemy the ability to do the same. One had to maintain security (which helps create surprise). This gave rise, and primacy, to the pursuit role. Pursuit was tasked with counter air missions; first, to deny the enemy air control, and then to gain it for the friendly forces.

As a parallel effort akin to the development of long range artillery, bombardment (the force application role) was developed. This became an additional means of in-

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[34] Cooke, Sky Battle: 1914-1918, The Story of Aviation in World War I, pp. 150, 183, 212, 249 and 261-262.

[35] Cyril Falls, The Nature of Modern Warfare, (New York: Oxford University Press, 1941), pp. 24-25, 28, 31-32, and 67.

creasing the enemy's friction which had a secondary objective of decreasing ones own by restricting the enemy's options to respond. Interdiction missions were preferred, even if slower acting, because their impact was often widespread and pervasive. However, costly close air support missions were sometimes required because they had the ability to provide immediate and decisive, even if local, influence on the battlefield.

The above stated doctrine was implicitly developed by applying the concept of friction. Strategically, no major power could ignore the need to develop an air force to counter the potential advantages in friction that an opponent could gain with their air arm. At the operational level, no general could ignore air power as the principal means to destroy the enemy by creating such friction that the enemy grinds to a stop and is overwhelmed. Therefore, air doctrine was implicitly developed to gain a decisive advantage in war by increasing the enemy's friction while decreasing ones own.

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